ATENT COOPERATION TR[illegible]

# PCT

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70) 14

| Applicant's or agent's file reference | FOR FURTHER ACTION | See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416) |
|---|---|---|
| TS 0743 PCT | | |
| International application No. | International filing date *(day/month/year)* | Priority date *(day/month/year)* |
| PCT/EP99/10447 | 22/12/1999 | 29/12/1998 |
| International Patent Classification (IPC) or national classification and IPC<br>B01J8/00 | | |
| Applicant<br>SHELL INTERNATIONALE RESEARCH MAATSCHAPPIJ ..et al | | |

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

   ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

| Date of submission of the demand | Date of completion of this report |
|---|---|
| 08/06/2000 | 22.03.2001 |
| Name and mailing address of the international preliminary examining authority:<br>European Patent Office<br>D-80298 Munich<br>Tel. +49 89 2399 - 0 Tx: 523656 epmu d<br>Fax: +49 89 2399 - 4465 | Authorized officer<br>Buesing, G<br>Telephone No. +49 89 2399 8356 |

Form PCT/IPEA/409 (cover sheet) (January 1994)

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/EP99/10447

## I. Basis f the report

1. This report has been drawn on the basis of *(substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments (Rules 70.16 and 70.17).)*:
**Description, pages:**

1-15 as originally filed

**Claims, No.:**

1-15 as originally filed

**Drawings, sheets:**

1/6-6/6 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

| | | |
|---|---|---|
| Novelty (N) | Yes: | Claims 1 - 15 |
| | No: | Claims |
| Inventive step (IS) | Yes: | Claims 1 - 15 |
| | No: | Claims |
| Industrial applicability (IA) | Yes: | Claims 1 - 15 |
| | No: | Claims |

2. Citations and explanations
**see separate sheet**

**S cti n V:**

1. Reference is made to the following documents:

   D1: DE-U-92 02 798
   D2: GB-A-2 303 860
   D3: DE-A-42 22 162

2. The catalytic reactor according to claim 1 comprises means for variably covering part of the upstream surface of the catalyst bed. Similar reactors are known from D1, D2 or D3. The claimed reactor is different from the prior art reactors in that the feed supply chamber has, during normal operation, no zones where the fluid flow is stagnant. This functional feature thus provides novelty of the claimed reactor.

   The functional feature is considered admissible because the ordinarily skilled worker in the art of reactor engineering knows whether the fluid flow in a reactor would be stagnant or not during normal operation by applying for example common rules of fluid dynamics. In view of the various embodiments of the invention disclosed in the application he is also taught how to design the reactor such that the functional feature is actually obtained.

3. Starting from any of D1, D2 or D3, the problem to be solved by the invention was how to provide for a reactor wherein the upstream surface of the catalyst can be covered as a function of reactant fluid throughput whilst avoiding uncontrolled gas-phase reactions upstream of the catalyst, such as explosion, ignition and flash-back of flames.

   The problem is solved by designing the reactor such that, during normal operation, stagnant zones do not occur upstream of the catalyst. This is, for example, achieved by the various embodiments disclosed in the drawings.

   The skilled person, seeking to solve the above problem will not find any teaching or suggestions in the cited prior art which would guide him to the invention.

4. Independent claims 13 and 15 and the dependent claims are all based on the same inventive concept. Novelty and inventive step can therefore be acknowledged for all claims on file.

PATENT COOPERATION TREATY

# PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

| Applicant's or agent's file reference | FOR FURTHER ACTION | see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below. |
|---|---|---|
| TS 0743 PCT | | |
| International application No. | International filing date *(day/month/year)* | (Earliest) Priority Date *(day/month/year)* |
| PCT/EP 99/ 10447 | 22/12/1999 | 29/12/1998 |
| Applicant | | |
| SHELL INTERNATIONALE RESEARCH MAATSCHAPPIJ ..et al | | |

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

   [ ] the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

   b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

   [ ] contained in the international application in written form.

   [ ] filed together with the international application in computer readable form.

   [ ] furnished subsequently to this Authority in written form.

   [ ] furnished subsequently to this Authority in computer readbie form.

   [ ] the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   [ ] the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. [ ] **Certain claims were found unsearchable** (See Box I).

3. [ ] **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

   [ ] the text is approved as submitted by the applicant.

   [X] the text has been established by this Authority to read as follows:

   CATALITIC REACTOR

5. With regard to the **abstract**,

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established, according to Rul 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No. 5a

   [ ] as suggested by the applicant.

   [ ] because the applicant failed to suggest a figure.

   [X] because this figure better characterizes th invention.

   [ ] None of th figures.

# INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 99/10447

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B01J8/00 B01J8/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B01J F02M H01M C01B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category ° | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | DE 92 02 798 U (EMITEC GESELLSCHAFT FÜR EMISSIONSTECHNOLOGIE MBH)<br>23 April 1992 (1992-04-23)<br>figure 6<br>page 13, line 25 -page 14, line 2<br>page 8, paragraph 30 -page 9, line 22<br>page 6, line 25 -page 7, line 12<br>page 3, line 35 -page 4, line 17<br>page 1, line 5 - line 28 | 1,2,4-6,<br>8,12-15 |
| X | GB 2 303 860 A (DAIMLER-BENZ AG)<br>5 March 1997 (1997-03-05)<br>figures 3-5<br>page 12, paragraph 2 -page 13, paragraph 1<br>page 10, paragraph 3 -page 11, paragraph 1<br>page 6, paragraph 1 -page 7, paragraph 1 | 1,2,4,8,<br>10,11,<br>13,15 |

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 4 April 2000 | 13/04/2000 |

| Name and mailing address of the ISA | Authorized officer |
|---|---|
| European Patent Office, P.B. 5818 Patentlaan 2<br>NL – 2280 HV Rijswijk<br>Tel. (+31–70) 340–2040, Tx. 31 651 epo nl,<br>Fax: (+31–70) 340–3016 | Stevnsborg, N |

1

Form PCT/ISA/210 (second sheet) (July 1992)

# INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 99/10447

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category ° | Citation of document, with indication,where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | DE 42 22 162 A (KLAUS JÜRGEN NORD)<br>14 January 1993 (1993-01-14)<br>abstract<br>column 1, paragraph 1<br>column 2, line 68 -column 4, line 1<br>column 5, line 11 -column 6, line 30<br>figures | 1,2,4,6,<br>8,13,15 |
| A | | 10 |
| A | US 4 134 425 A (HORST GÜSSEFELD & HEINZ CHRISTOPH) 16 January 1979 (1979-01-16)<br>column 2, line 30 -column 3, line 44<br>column 3, line 58 -column 5, line 27<br>figures 1,2 | 1,2,4-7,<br>10,13,14 |
| A | PATENT ABSTRACTS OF JAPAN<br>vol. 11, no. 297 (C-448),<br>25 September 1987 (1987-09-25)<br>-& JP 62 087401 A (FUJI ELECTRIC CO LTD.),<br>21 April 1987 (1987-04-21)<br>abstract; figures | 1 |
| A | DE 11 38 290 B (BADISCHE ANILIN- &<br>SODA-FABRIK AKTIENGESELLSCHAFT)<br>the whole document | 1 |
| A | GB 1 367 941 A (SHELL INTERNATIONALE<br>RESEARCH MAATSCHAPPIJ N.V.)<br>25 September 1974 (1974-09-25) | |
| A | US 5 776 421 A (MITSUIE MATSUMURA & TOSIO<br>SHINOKI) 7 July 1998 (1998-07-07)<br>abstract; figures 1A,1B | |

1

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/EP 99/10447

| Patent document cited in search report | | Publication date | Patent family member(s) | | Publication date |
|---|---|---|---|---|---|
| DE 9202798 | U | 23-04-1992 | NONE | | |
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| US 5776421 | A | 07-07-1998 | JP | 9030801 A | 04-02-1997 |

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International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 :
B01J 8/00, 8/02

A1

(11) International Publication Number: WO 00/38828

(43) International Publication Date: 6 July 2000 (06.07.00)

(21) International Application Number: PCT/EP99/10447

(22) International Filing Date: 22 December 1999 (22.12.99)

(30) Priority Data:
98310768.1 29 December 1998 (29.12.98) EP

(71) Applicant *(for all designated States except US)*: SHELL INTERNATIONALE RESEARCH MAATSCHAPPIJ B.V. [NL/NL]; Carel van Bylandtlaan 30, NL–2596 HR The Hague (NL).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: WENTINCK, Hendrik, Martinus [NL/NL]; Badhuisweg 3, NL–Amsterdam 1031 (NL). SMIT, Jacobus, Antonius, Jozef [NL/NL]; Badhuisweg 3, NL–1031 CM Amsterdam (NL).

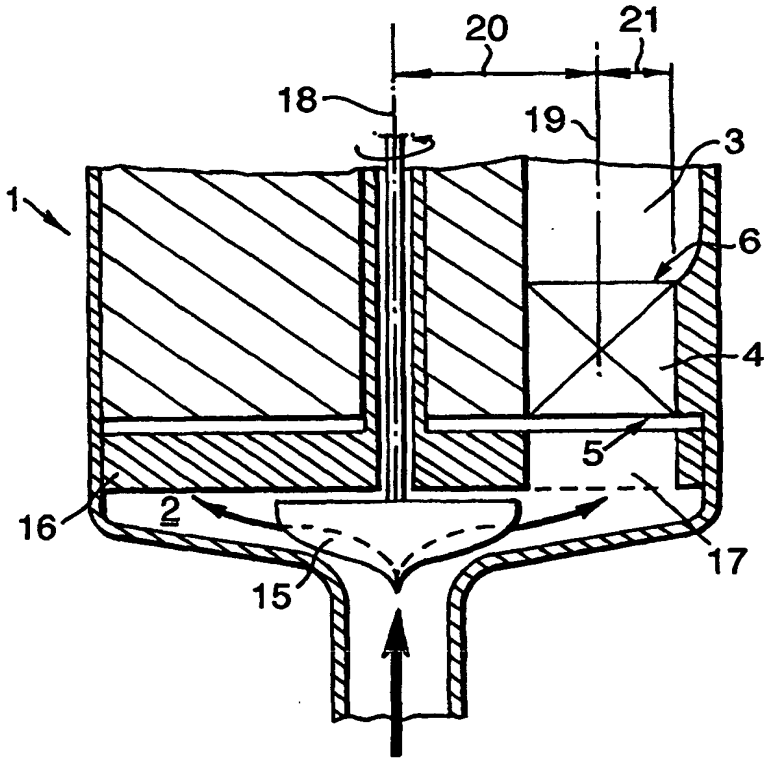
(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

**Published**
*With international search report.*

(54) Title: CATALYTIC REACTOR

(57) Abstract

The invention relates to a reactor (1), suitable for the catalytic conversion of a feed mixture which is capable of explosion and/or ignition, comprising a feed supply chamber (2), an effluent discharge chamber (3), a catalyst bed (4) having an upstream surface (5) and a downstream surface (6) which is in fluid communication with the effluent discharge chamber (3), and means for covering part of the upstream surface (5) that partly confine the feed supply chamber (2), wherein the feed supply chamber (2) has, during normal operation, no zones where the fluid flow is stagnant, to the use of such a reactor (1), in particular a catalytic partial oxidation process, and to transport means provided with such a reactor (1).



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# INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 99/10447

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B01J8/00 B01J8/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B01J F02M H01M C01B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category ° | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | DE 92 02 798 U (EMITEC GESELLSCHAFT FÜR EMISSIONSTECHNOLOGIE MBH)<br>23 April 1992 (1992-04-23)<br>figure 6<br>page 13, line 25 -page 14, line 2<br>page 8, paragraph 30 -page 9, line 22<br>page 6, line 25 -page 7, line 12<br>page 3, line 35 -page 4, line 17<br>page 1, line 5 - line 28 | 1,2,4-6,<br>8,12-15 |
| X | GB 2 303 860 A (DAIMLER-BENZ AG)<br>5 March 1997 (1997-03-05)<br>figures 3-5<br>page 12, paragraph 2 -page 13, paragraph 1<br>page 10, paragraph 3 -page 11, paragraph 1<br>page 6, paragraph 1 -page 7, paragraph 1 | 1,2,4,8,<br>10,11,<br>13,15 |

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 4 April 2000 | 13/04/2000 |

| Name and mailing address of the ISA | Authorized officer |
|---|---|
| European Patent Office, P.B. 5818 Patentlaan 2<br>NL – 2280 HV Rijswijk<br>Tel. (+31–70) 340–2040, Tx. 31 651 epo nl,<br>Fax (+31–70) 340–3016 | Stevnsborg, N |

Form PCT/ISA/210 (second sheet) (July 1992)

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category ° | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | DE 42 22 162 A (KLAUS JÜRGEN NORD)<br>14 January 1993 (1993-01-14)<br>abstract<br>column 1, paragraph 1<br>column 2, line 68 -column 4, line 1<br>column 5, line 11 -column 6, line 30<br>figures | 1,2,4,6,<br>8,13,15 |
| A | | 10 |
| A | US 4 134 425 A (HORST GÜSSEFELD & HEINZ CHRISTOPH) 16 January 1979 (1979-01-16)<br>column 2, line 30 -column 3, line 44<br>column 3, line 58 -column 5, line 27<br>figures 1,2 | 1,2,4-7,<br>10,13,14 |
| A | PATENT ABSTRACTS OF JAPAN<br>vol. 11, no. 297 (C-448),<br>25 September 1987 (1987-09-25)<br>-& JP 62 087401 A (FUJI ELECTRIC CO LTD.),<br>21 April 1987 (1987-04-21)<br>abstract; figures | 1 |
| A | DE 11 38 290 B (BADISCHE ANILIN- & SODA-FABRIK AKTIENGESELLSCHAFT)<br>the whole document | 1 |
| A | GB 1 367 941 A (SHELL INTERNATIONALE RESEARCH MAATSCHAPPIJ N.V.)<br>25 September 1974 (1974-09-25) | |
| A | US 5 776 421 A (MITSUIE MATSUMURA & TOSIO SHINOKI) 7 July 1998 (1998-07-07)<br>abstract; figures 1A,1B | |

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/EP 99/10447

| Patent document cited in search report | | Publication date | Patent family member(s) | | Publication date |
|---|---|---|---|---|---|
| DE 9202798 | U | 23-04-1992 | NONE | | |
| GB 2303860 | A | 05-03-1997 | DE | 19526886 C | 12-09-1996 |
| | | | FR | 2736907 A | 24-01-1997 |
| | | | IT | RM960425 A | 15-12-1997 |
| | | | US | 5772707 A | 30-06-1998 |
| | | | US | 5989503 A | 23-11-1999 |
| DE 4222162 | A | 14-01-1993 | NONE | | |
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| | | | CA | 1091543 A | 16-12-1980 |
| | | | FR | 2343912 A | 07-10-1977 |
| | | | GB | 1581729 A | 17-12-1980 |
| | | | JP | 52111470 A | 19-09-1977 |
| JP 62087401 | A | 21-04-1987 | NONE | | |
| DE 1138290 | B | | NONE | | |
| GB 1367941 | A | 25-09-1974 | NL | 7015312 A | 21-04-1972 |
| | | | BE | 773741 A | 11-04-1972 |
| | | | CA | 957830 A | 19-11-1974 |
| | | | DE | 2151793 A | 20-04-1972 |
| | | | FR | 2111485 A | 02-06-1972 |
| US 5776421 | A | 07-07-1998 | JP | 9030801 A | 04-02-1997 |